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METHOD FOR PHYSICAL ANALYSIS AND DETERMINATION OF MOISTURE IN SOLID WASTES (EXCLUDING INDUSTRIAL SOLID WASTES)

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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(*First cover page, pages* 1 *and 3. title*) — Substitute title of the standard as follows in the cover page and wherever it appears

METHOD FOR DETERMINATION OF MOISTURE IN SOLID WASTES (EXCLUDING INDUSTRIAL WASTES)'

(CHD 32)

Reprography Unit, BIS, New Delhi, India

Indian Standard

METHOD FOR PHYSICAL ANALYSIS AND DETERMINATION OF MOISTURE IN SOLID WASTES (EXCLUDING INDUSTRIAL SOLID WASTES)

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Indian Standard

METHOD FOR PHYSICAL ANALYSIS AND DETERMINATION OF MOISTURE IN SOLID WASTES (EXCLUDING INDUSTRIAL SOLID WASTES)

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 16 July 1979, after the draft finalized by the Solid Wastes Sectional Committee had been approved by the Chemical Division Council.

0.2 The term ' solid waste ' as used in this standard includes raw refuse (domestic, shop, office, institutional and street) delivered to a processing facility, or in various stages of composting. It also includes residues of the incineration process.

0.3 In the preparation of this standard, considerable assistance has been derived from the publication ' Methods of sampling and analysis of solid wastes. Section for solid waste, EAWAG, CH 8600 Dubendorf (Switzerland) issued by the Swiss Federal Institute for Water Supply, Sewage Purification and Water Pollution Control.

0.4 In reporting the result of a test or analysis, made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard prescribes a method for physical analysis and determination of moisture in solid wastes excluding industrial wastes.

2. GENERAL REQUIREMENTS OF SAMPLING

2.0 It is of utmost importance for all analyses that the samples be representative. Cursory samplings reveal very little about the true composition of the material and may lead to erroneous conclusions.

---

*Rules for rounding off numerical values (*revised*).

2.1 Refuse

2.1.1 A mobile hammermill shall be used to take a crude sample of refuse so that the refuse to be examined may be ground and homogenized on the spot.

2.1.2 Crude refuse 100 to 200 kg may be taken as the basic unit for a sample which may be taken at variable intervals depending on the amount of waste In accordance with the purpose of the analysis, 2 to 4 individual samples mav be ground together in order to reduce the number of samples during more lengthy tests.

2.1.3 The ground refuse has to be mixed intensively. During mixing, about 10 to 20 small mdividual portions are taken and filled into air-tight plastic bags in quantities of 1 to 2 kg, to be stored as samples. This heterogeneous mixture is the *crude sample.*

2.2 Compost — Grab samples (1 to 2 kg) shall be taken from as many parts of the windrow as possible and well mixed It shall be ensured that equal amounts are taken from all parts. The actual sample of 1 to 2 kg shall be taken from this mixture. In the same way compost samples shall be taken from the test material in plastic baskets and small windrows. The mixture obtained in this way is the *crude sample.*

2.3 Sewage Sludge — Before a sample is taken, the sewage sludge shall be well homogenized However, too intensive mixing with a high speed agitator should be avoided if the sample is to be used in dehydration tests (flocculation and filtration tests) The sewage sludge obtained In this way is the *crude sample.*

2.4 Residue After Incineration

2.1.1 The crude sample shall be taken directly from the conveying system under examination if possible. Fly ash and riddlings shall be taken from the corresponding areas.

2.4.2 The size of the sample shall depend on the kind of information sought and the structure of the material. In the case of single samplings (which may have a random composition), a targe quantity should be taken and prepared For longer examination periods, in which several Single Samples are taken at smaller intervals, the quantity may be fixed at 100 kg per sampling. Considerable deviations may occur with smaller quantities.

2.4.3 Depending on the information sought, 2 to 4 single satnpllngs may be ground and mixed in order to limit the number of samplings for lengthier tesrs.

3. PREPARATION OF SAMPLES

3.1 Crude samples are not ready for examination. They should be ground and homogenized further after drying. The moisture content of the crude sample is determined during drying. It is essential that this moisture content of sample is measured as soon as possible after the sample Is collected.

NOTE — If any moisture is found condensed on the walls of the container, it should be reabsorbed in the sample.

4. DETERMINATION OF MOISTURE

4.1 Procedure — In order to determine the moisture content, weigh the entire *crude sample.* Spread It thinly and dry in a drying oven till its mass becomes constant. Drying may be generally done at 105°C but in case of combustibles the temperature shall be 70 to 75°C. However, if microbiological tests are also to be conducted, drying shall be done at 40 to 50°C. The dried crude samples are somewhat hygroscopic. They shall be left to cool in a turned off drying oven and weighed immediately afterwards.

4.2 Calculation

$$DS + W = 100\ (NS)$$

$$c = a - b$$

$$W = \frac{c - e}{c} \times 100$$

$$DS = \frac{e}{c} \times 100$$

where

DS = dry substance of the *crude sample,* percent by mass;

W = moisture content of the *crude sample,* percent by mass;

NS = non-dried substance of the *crude sample',*

c = net mass, wet;

a = gross mass, wet;

b = mass of receptacle (tare);

d = gross mass, dried; and

e = net mass, dried.

5. SEGREGATION AND GRINDING

5.1 Waste material may contain glass, ferrous and non-ferrous metals, plastics, etc. Glass and ceramics may be separated by judicious sieving, plastics and non-ferrous metals may be hand-picked and ferrous metals may be removed by a strong magnet.

5.2 The remaining material may by ground with an appropriate pulverising equipment (crushing mill, hammermill, ball mill, knife mill) until it becomes a farmaccous, homogeneous powder which is sifted through a 0.5 mm screen. The screening residue should be ground thoroughly to particles of the smallest size possible. The material in the form of sample is now ready for analysis.

5.3 The separated material may further be segregated into organic and inorganic portion. The organic portion consists mainly of paper, rubber, plastics, wood, textiles and cork. A part of these materials may be pulverized even further with a knife mill and mixed with the sample. This is of importance if it is desired to determine the carbon content of fermentable organic substance and volatile substance. The mass of the remaining material shall be determined and expressed as a percentage of the dry substance and referred to as the organic screening residue.

5.4 The inorganic screenmg residue consists almost exclusively of metals. They shall be cleaned with air pressure and their mass determined and expressed as a percentage of the dry substance,

5.5 The screening residue should be taken into account when calculating the results of analysis of the *crude sample.* The inorganic screening residue shall be considered inert while calculating the calorific value. An approximate value shall be used for the organic part, if necessary,

6. RESULTS OF ANALYSIS

6.0 The moisture content of the *crude sample* is closely linked with the place and method by which it was taken and whether it was immediately mixed and filled into containers or only after some time.

6.1 To facilitate comparison of results, the data of analysis shall be normally calculated on the basis of dry substance.

6.2 When a single crude sample is drawn and analysed in order to obtain information about the quantity of a sample unaffected by a process or to determine its state, it shall be referred to as *single analysis.*

6.3 When crude samples are taken and analyzed at various intervals depending upon purpose and process, it shall be referred to as *series analysis.*

6.4 Single Analyses — These shall be calculated as given below.

6.4.1 Evaluation shall be done on the basis of dry substance (DS) in percentage by mass.

6.4.2 Evaluation shall be done on the basis of the non-dry substance (NDS) also in percentage by mass.

6.5 Series Analyses — These shall be calculated as given below.

6.5.1 Evaluation shall be done on the basis of initial dry substance (IDS) in percentage by mass.

6.5.2 The results of analysis of a series of tests carried out to follow fermentation shall be calculated on the basis of the following assumptions:

a) The ash content remains constant during fermentation from the quantitative point of view. The organic part, however, decomposes and hence there is a quantitative reduction.

b) All results may be converted and compared with each other with the aid of sample's ash content as well as IDS of the sample.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of stubstance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Foree	newton	N	1 N = 1 $kg.m/s^2$
Energy	joule	J	1 J = 1 N.m
Power	wait	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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